Setting the Standard for Automation™

Water / Wastewater Industry Division

Calendar of WWID Events

Jun 13-16, 2021 AWWA ACE 2021

Summer 2021 **2021 ISA Energy and Water Automation Conference (EWAC)** Online Format – Dates TBD

Summer 2021 WWID Connect Live virtual events Dates/Times TBD

Oct 16-20, 2021 WEF WEFTEC 2021

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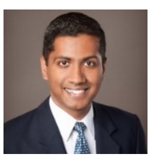
Newsletter
Winter 2021

Director's Welcome

Manoj Yegnaraman, Carollo Engineers Inc.



A warm welcome to our worldwide Water Wastewater Industries Division (WWID) members. I am both honored and excited to take on the role of WWID Director, and to continue to be a part of our Division Board that comprises a dedicated team of automation professionals.

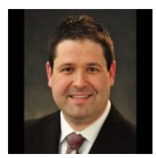
I would like to thank past-director Don Dickinson for his support and assistance in helping me transition into this position. His leadership sets a high benchmark for the future—and I am prepared to take on the opportunities and challenges this position brings. Thanks to Hassan Ajami, who took over my previous roles of WWID Director-Elect and Energy Water Automation Conference (EWAC) Chair.

I joined ISA in 2001, and have been a Senior Member since 2011. I have been working for Carollo Engineers since 2006 as a consulting engineer for the water/wastewater (WW) industry. In addition to WWID, I continue to be involved with several other ISA activities such as standards, conferences, sections and scholarships. Most importantly, I've had the pleasure to learn from and network with numerous passionate automation professionals in the WW industry. And, I look forward to more in the coming years.

Our world is constantly changing. One on hand, we have been observing innovative technological advancements focusing on efficiencies and a higher.... **(continued on page 2)**

Newsletter Editor's Welcome

Graham Nasby, City of Guelph Water Services



Welcome to our Winter 2021 newsletter! I don't know about you, but I'm really looking forward to the year ahead. 2020 was the year we learned what a global pandemic looks like, and got to try out new ways of working so we could all keep our important municipal infrastructure online. We did it! Modern society didn't collapse, and we managed to keep both the water flowing and protect the environment. We also have good news on the horizon with effective public health measures and a rapidly improving vaccine situation. I am looking forward to us to being able to put the pandemic behind us soon.

Now that we have this COVID-19 thing figured out, it's time for us to get back to the core business of what we do. All of us in automation are in the service business – and SCADA is the service we provide. It is SCADA that enables the automatic control of water/wastewater facilities, enables the providing of effective tools for our operations teams, and enables the automation of many of the regulatory needs of our sector. I view it as simply magical how we are able to use SCADA to implement automatic control schemes, automatic abnormal condition handling (permissives and interlocks), high performance HMIs, automatic data logging, and reporting systems to make modern water/wastewater utilities so much easier to operate. Technology in the right hands can do many great things, and we all play a vital role of applying it in an effective way. I'm also really… **(continued on page 3)**

WWID Director's Message
(continued from Page 1)

….quality of life. Unfortunately, on the other hand, we have seen more challenges related to climate/environment, global health, cybersecurity, and aging infrastructure/workforce. All of these have an impact on our WW industry.

A September 2020 article by Forbes on "The 5 Biggest Technology Trends In 2021 Everyone Must Get Ready For Now"[1] lists the following trending technologies: Artificial Intelligence, Robotics (and other related automation), the "As-a-service" revolution (cloud-based and on-demand platforms), 5G, and Extended Reality (XR – VR and MR). Since all items listed above have been (and/or can be) adapted into our industry, it is essential for us to keep up with these advancements, so that we can collaborate and bring about more efficiencies into the day-to-day management, operations and maintenance of WW facilities.

While we have a task at hand to make things better using the above-mentioned technologies, we also have an equal role in addressing the challenges that our industry constantly faces. The challenges that I have identified above are all interconnected to each other. The United Nations Foundation has created 17 Sustainable Development Goals[2] (SDGs) to collectively address these challenges. Out of these, Goal 6 is to "Ensure availability and sustainable management of water and sanitation for all". Furthermore, the COVID-19 pandemic has made us realize the importance for water, sanitation and hygiene now more than ever. Here again, the goals of an WW automation professional should be to enable efficient management/operability/maintainability, that eventually results in the overarching vision to ensure availability of water and sanitation for all.

Several of you reading this article may have been directly or indirectly involved in what I have mentioned above. We thank you for your products and services, and we look forward to learning and working with you via this Division.

Our Division consists of individuals who focus on planning, designing, engineering, management, operation, maintenance, products and integration as it relates to the WW industry. I see our ISA WWID as the best platform to collaborate, discuss lessons learned, and to come up with best practices in order to provide a high quality of service for our industry.

Simply put, our WWID Vision is to serve as a valuable resource for our Water and Wastewater Industry. And our WWID Mission is to provide such valuable information to our WWID members via various communication platforms.

For those who are new to ISA and/or our Division, here are the various methods in which the WWID Division provides valuable technical content to our members every year – Newsletters, Emails, isawaterwastewater.com website, ISA WWID LinkedIn page, Webinars, Annual Conference/Symposium, and associated ISA training conducted during the annual event. Starting this year, we will also be utilizing ISA's newest platform – ISA Connect to host Live Meetings. We have planned to conduct several Connect Live meetings related to our Water Wastewater Industry this year.

I am excited to let you know that we have several new WWID Board Members this year. Please check out our ISA WW website (www.isawaterwastewater.com) and the ISA Connect WWID page (www.isa.org/wwid) for a list of Board Members along with their contact information.

Our Division cannot exist without the support, technical expertise, collaboration and participation from all of you. I want to thank each and every one of you on behalf of our ISA WWID Board. I look forward to working with you and learning from all of you. I welcome the opportunity to hear from you, whether to share your thoughts and ideas, or simply to say, "Hello."

Warmest Regards,

Manoj Yegnaraman, PE
2021-2022 Director, ISA WWID
Associate VP, Carollo Engineers Inc.
myegnaraman@carollo.com

[1] https://www.forbes.com/sites/bernardmarr/2020/09/14/the-5-biggest-technology-trends-in-2021-everyone-must-get-ready-for-now/
[2] https://sdgs.un.org/goals

Newsletter Editor's Welcome
(continued from Page 2)

…excited by the recent work being done by the ISA112 SCADA systems standards committee to help make SCADA systems and projects more manageable for everyone involved.

Now sporting over 210 SCADA experts from around the world and from a wide range of industries that use SCADA, the ISA112 committee has made significant progress in the past 4 years. In the summer of 2020, the ISA112 committee released both a SCADA management lifecycle and a reference architecture that are now freely available to download as PDFs at www.isa.org/isa112 . Coupled together, these two key diagrams now provide a comprehensive framework that can be used to guide best practices for both standardization and management of SCADA systems for any application, no matter the size, budget, industry or geographic industry.

The ISA112 committee is also now hard at work at preparing a new SCADA system maturity model, which is due to be released very shortly. Much like other maturity models, the ISA112 SCADA maturity model will provide a way for organizations to look at how well they are managing, maintaining and planning for their SCADA assets. A major component of the maturity model will be looking at system documentation, system standards, how system change requests are handled, and how long-term planning is mapped out. As the co-chair of the ISA112 committee, I am very much looking forward to the release of the new ISA112 SCADA maturity models, as I personally feel the maturity model will be of great service to the municipal water/wastewater sector.

For additional info on the ISA112 SCADA systems standards committee, an update article can be found on page 12 of the newsletter. A more in depth article about the ISA112 SCADA management lifecycle and ISA112 model architecture can be also found in the summer 2020 issue of this newsletter.

Speaking of the newsletter, we have several great articles to share with you in this issue. Don Dickinson, who was our 2020 WWID Director, has provided a year 2020 in review article that you can find on page 4. We also have several technical articles in this issue. Pamela Horbachovsky from OMRON provides an article on e-stop button best practices for machinery applications in water/wastewater plants. James Redmond from Schneider Electric provides an article about automatic code migration tools. And, there is an article that provides an overview of the ISA's currently active standards committees. We also have a message from ISA Society President Steve Mustard also welcoming us into 2021.

Thanks for reading, and do keep us in mind for your article ideas. See page 19 for information on how to submit an article.

Graham Nasby, P.Eng.
WWID Newsletter Editor
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WELCOME

Director Elect's Welcome

Hassan Ajami, PCI-Vertex

2020…the year that the world was turned on its head and affected all of our daily lives. Through all the outbreaks, lockdowns, industry shutdowns, the work in the Water/Wastewater sector kept moving along. There's nothing more essential than providing water!

I've been involved with ISA Water Wastewater Industries Division (WWID) for over 10 years and this is my first year as the Director-Elect. I'm excited to serve in this role to assist Manoj Yegnaraman as we plot a course for our division through a new landscape, both in the industry and within ISA. My first real involvement with WWID was through the ISA Water Wastewater and Automatic Controls (WWAC) conference that the division put together. This later became the ISA Energy Water Automation Conference (EWAC) that we currently have.

It was a great opportunity to present new topics, learn from other industry professionals, and expand my network. I enjoyed WWAC (and later EWAC) so much that I've attended every one since, even joining the conference committee. As our world transitioned to a virtual environment for almost all activities, it brought on new challenges and the potential for new opportunities. We've all had to deal with transitioning to alternate work arrangements, limited field access and resources, and new safety and testing protocols. These are all compounded by the continuing challenges that our industry faces, such as limited knowledge transfer, security risks, and funding.

I find that groups such as WWID are an excellent place to brainstorm ideas, learn about how others are tackling similar issues, and learn more about what's coming next in the automation industry. My goal with WWID is to expand our reach through new members, expand opportunities for existing members to get involved, share new and exciting automation technologies, real-world case studies and best practices with you via newsletters, webinars, conferences, and our ISA WWID LinkedIn group. On behalf of the ISA WWID committee, I want to thank each and every one of you for being involved in Automation for the W/WW industry. The success of our Division is a direct implication of your contributions, and our past and current volunteers/leaders.

Your services and products have a direct positive impact on the communities we live in. Thank you for all of your efforts in making this world a better place. Take care, stay safe and enjoy 2021.

Hassan Ajami, PE, CAP
2021-2022 Director-Elect, ISA WWID
2021-2022 General Chair, ISA EWAC
Vice President / Lead Technical Officer
hajami@pci-vertix.com

WWID NEWS

Looking back at 2020: 20/20 of 2020?

By Don Dickinson, Phoenix Contact USA

There's a well-known phrase, "Hindsight is 20/20." The word hindsight refers to looking back or reflecting on things in the past, and 20/20 refers to perfect vision. When we look back on situations in the past, we see things clearly that were not clear to us at the time. However, looking back on 2020, it still is unclear how we ultimately will be affected by the disruption in our lives caused by COVID-19, or the tumult and unrest stemming from political and social polarization. Even with the promise of vaccines and a moderation of political rhetoric, it is hard to envision how these and other significant challenges will be resolved. What can be seen clearly, is how people and organizations successfully responded and adapted to a new reality that threatens to overwhelm us still.

The good news is, ISA clearly met the challenges of 2020, and is now positioned better than ever to address the needs of its members, and to fulfill its vision of creating a better world through automaton. But it wasn't easy. There was uncertainty surrounding the ISA Strategic Leadership Conference held in early March in Austin, Texas, USA. The impact of COVID-19 was just beginning to be felt. Many had to cancel plans at the last minute as concerns about travel and exposure to the virus grew. Those who did attend got the first glimpse of a new platform: ISA Connect, which would take ISA – and its members – into the digital realm.

ISA Connect (https://connect.isa.org) is a members-only, online network for communication and collaboration. For those given early access during the summer as the platform was being completed, it was obvious ISA Connect would be not only a valuable resource during lockdown, but also a resource to expand and enhance the ISA member experience into the future. ISA Connect was officially rolled out in the Fall, and continues to gain traction as members learn how to make use of its many features.

ISA Connect offers members new ways to connect with fellow members around the world, and share knowledge through technical discussions, community engagement, and a wide range of resources. Of note is the ISA Connect, Water & Wastewater Industry Division (WWID) web page where you find resources specific to the WWID. However, because ISA Connect is for members only, the WWID maintains a public-facing web page to promote the WWID to non-members (www.isawaterwastewater.com). Many thanks to Graham Nasby, our Webmaster, for his contributions to both sites.

The introduction of ISA Connect during 2020 was fortuitous for members adapting to new working conditions that for many meant working from home, and lacking the traditional means of engagement through in-person events. As of March 2020, all ISA in-person events were cancelled for the year, including ISA's 2020 Energy and Water Automation Conference (EWAC) conducted by the WWID and the Power Industries Division (POWID). Despite the abrupt change in well-established programs and schedules, ISA staff organized and directed numerous virtual events and conferences – a huge undertaking! To support that effort, members of the WWID responded by working with ISA staff and POWID members to plan and conduct four virtual webinars. All four events went off very well even with the sudden change in plans, and uncertainty dealing with new event formats and online platforms. More importantly, the experience gained conducting virtual events will benefit the expected expansion of virtual events and conferences in 2021.

The four webinars held last year were:

- Taking Action on Cybersecurity Risks in the Water Sector by Kevin Morley (July 28, 2020)
- Managing Energy Expenses Using Behind-the-Meter Solar – Storage and Artificial Intelligence by Norman Sendler (Aug 27, 2020)
- Control System Cybersecurity for Water/Energy Utilities by Jonathan Grant (September 22, 2020)
- Energy Awareness for Industrial Process Automation Systems by Jose Pina (Oct 2, 2020)

COVID-19 has brought abrupt and indelible changes to all aspects of our lives, personally and professionally. While is impossible to know how all this will play out in time, looking back on 2020, it is clear that ISA and the WWID were not deterred by unprecedented challenges, but instead we were able to manifest ISA's vision of creating a better world through automation. Let's resolve to do the same in 2021!

WWID NEWS

Thanks to our outgoing 2020 WWID Board

From the ISA WWID volunteer committee

The ISA Water/Wastewater Division is led by a group of dedicated volunteers from wide range of roles in the municipal water sector. This includes: water utilities, consultants, vendors, distributors, system integrators, and construction companies.

The WWID's board consists entirely of volunteer members, who are supported by the ISA's professional association staff. The volunteer position of Director is selected by the board and serves a 2 year term. Our committees consist entirely of volunteers, who are supported by the ISA's staff.

We have a wide range of volunteers from around the world, and many of our volunteers have been with us for over 20 years. We also have several student and young professional members in our ranks. Volunteering with the division is open to all interested persons.

The year 2021 is one of new beginnings, and we look forward to the year ahead. The WWID would like to thank its volunteers from the past year.

Thanks to our 2020 WWID Volunteers

2020 Director
Don Dickinson
Phoenix Contact USA
Cary, North Carolina, USA

2020 Director-Elect &
2019-2020 General Chair, ISA EWAC Conference
Manoj Yegnaraman, PE, CP/CE(Profibus)
Carollo Engineers Inc.
Dallas, Texas, USA

2020 Past Director
Pavol Segedy, PE
HDR Inc.
Raleigh, North Carolina, USA

2020 Program Chair
Joe Provenzano
KPRO Engineering Services
Naugatuck, Connecticut, USA

2020 Membership Chair
Colleen Goldsborough
United Electric Supply
Lancaster, Pennsylvania, USA

2020 Asst. Membership Chair
Juliana Wafer, PE
Signature Automation
San Antonio, Texas, USA

2020 Secretary
David Wilcoxson, PE
Stantec Consulting Inc.
Walnut Creek, California, USA

2020 Newsletter Editor
& Co-Chair, ISA112 SCADA Systems Standards Committee
Graham Nasby, P.Eng, PMP, CAP
City of Guelph Water Services
Guelph, Ontario, Canada

2020 Scholarship Committee Chair
& Asst. Newsletter Editor
Kevin Patel, PE, MBA
Signature Automation
Dallas, Texas, USA

2019-2020 Assistant Conference Contact
Hassan Ajami, PE, CAP
PCI-Vertix
Detroit, Michigan, USA

Committee Member
David Hobart, P.Eng, CAP
Hobart Automation Engineering
Portland, Maine, USA

Committee Member
Steve Valdez
General Electric
Paramus, New Jersey, USA

Outgoing 2020 Water/Wastewater Division Student Scholarship Committee

- Kevin Patel, Signature Automation (chair)
- Sean McMillan, Jones & Carter
- Thomas C. McAvinew, I&C Engineering
- Wally Ingham, Volunteer

Outgoing 2020 Water/Wastewater Division Program Committee

- Joe Provenzano, KPRO Engineering Services (chair)
- Jaime Alba, PE – DC Water Authority
- Bob Dusza – City of Manchester Water and Sewer Department
- Carter Farley – InstruLogic LLC
- Joshua Gelman, PE – CDM Smith
- Jon Grant – Woodard & Curran Inc.
- Jason Hamlin – InstruLogic LLC
- David Hobart, PEng, CAP, ISA84-SFS – Hobart Automation Engineering
- Lucas Jordan, PE – MR Systems
- Maxym Lachance, PEng – BBA Inc.
- Paul McGuire, PE – North East Ohio Regional Sewer District
- Jonathan Mitchell – c2i Inc.
- Tony Morelli, PE – Publix Super Markets

- Graham Nasby, P.Eng., PMP, CAP – City of Guelph Water Services
- Vickie Olson – Honeywell Process Solutions
- Kevin Patel, PE – Signature Automation
- Pavol Segedy, PE – HDR Inc.
- David Wilcoxson, PE, LEED AP, ENV SP – Stantec Consulting

Outgoing 2020 Water/Wastewater Division Advisory Committee

- Hassan Ajami, PCI Detroit
- Jaime Alba, PE – DC Water Authority
- Norman Anderson, PE – Carollo Engineers Inc.
- Jeff Blue, PE, CAP – Southern Nevada Water Authority
- Ryan Costello, CET – NLS Engineering
- Tom DeLaura, PE – DeLaura Consulting LLC
- Jon DiPietro – Liberty Digital Marketing
- Bob Dusza – City of Manchester Water and Sewer Department
- Carter Farley – InstruLogic LLC
- Jonathan Mitchell – c2i Inc.
- Joshua Gelman, PE – CDM Smith
- Jon Grant – Woodard & Curran Inc.
- Jason Hamlin – InstruLogic, LLC
- Colleen Hart – United Electric Supply
- David Hobart, PEng, CAP, ISA84-SFS – Hobart Automation Engineering
- Lucas Jordan, PE – MR Systems
- Maxym Lachance, PEng – BBA Inc.
- Paul McGuire, PE – North East Ohio Regional Sewer District
- Sean McMillan, PE – Jones & Carter
- Tony Morelli, PE – Publix Super Markets
- Graham Nasby, P.Eng., PMP, CAP – City of Guelph Water Services
- Vickie Olson – Honeywell Process Solutions
- Kevin Patel, PE – Signature Automation.
- Matt Phillips, P.Eng. – C3 Water
- Joe Provenzano – KPRO Engineering Services
- Pavol Segedy, PE – HDR Inc.
- Bryan Sinkler – Trihedral Engineering
- David Wilcoxson, PE, LEED AP, ENV SP – Stantec Consulting
- Manoj Yegnaraman, PE – Carollo Engineers Inc.

Interested in volunteering with the ISA Water/Wastewater Division? Feel free to contact any of our volunteer leaders listed on the back page of his newsletter.

ISA Water/Wastewater Industry Division

WWID WEBINARS

ISA & WWID Continue to Provide Virtual Events and Plan for 2021 and Beyond

From the WWID program committee

With the unprecedented cancellations of in-person events due to the COVID-19 pandemic, our industry has had to pivot to providing online events. Both the WWID and ISA as a whole, has been actively working to adapt to this new format.

For the WWID, this has meant providing a series of technical webinars for our members. We started off with four webinars in July and September 2020. The Webinars are free, so we encourage you to register and attend future events. Keep an eye on the ISA website for more announcements.

In addition to WWID-associated events, the ISA has also embarked on providing a wide range online programming:

These include:

- Virtual Conferences
- Cybersecurity Series Webinars
- IIOT & Smart Manufacturing Webinars
- Digital Transformation Webinars
- Process Control and Instrumentation Webinars
- Division-Specific Webinars
- ISA Connect Live Events

Please visit www.isa.org/virtualevents for more information.

TECHNICAL ARTICLE

Tips on choosing appropriate E-Stop Technology for your Machine Safety Application

Pamela Horbacovsky, OMRON

An emergency stop – or E-Stop – is an essential component of safety systems, particularly when it comes to machine safety. Usually in the form of a retentive pushbutton, an E-Stop functions as either a Category 0 or Category 1 stop. The required e-stop category is determined by conducting a risk assessment of the machine it is attached to. When they are used, the role of E-stops is to shut the machine down quickly and safely in the event of a hazardous situation.

Selecting an E-Stop Technology

There here are strict guidelines concerning the compliance of emergency stop pushbuttons, the bulk of which are focused on making the button easy to access and press. However, there are certain applications in which even a standards-compliant pushbutton may not be the ideal solution. These applications can usually be improved with a technology known as a rope switch. With that said, here is some guidance for when designing a system that uses pushbutton e-stops.

Compliance requirements for E-Stop pushbuttons

In many machine safety applications, a pushbutton will suffice. An emergency stop pushbutton must be colored red and must be mounted upon a bright yellow background. The yellow background must be a minimum of 3mm beyond the mounting collar and visible beyond the control actuator according to ANSI B65.1-2005.

The actuator of a pushbutton-operated device is required to have a mushroom-head shape. Flush or membrane-style switches are not permitted, and neither are graphical representations of a button on an HMI or flat panel display. While the coloring is designed to ensure that it can be easily located, the purpose of the mushroom-head shape is to make it easy to push.

E-stop pushbuttons need to be located at each operator control station and at any other location where an emergency stop would be required. The buttons must be self-latching, meaning that they can only be reset manually. They also need to have direct opening operation. As with all E-stop devices, a pushbutton must remain unguarded.

Figure 1 – Red Mushroom-head Retentive E-Stop Buttons

When to use rope switches as an alternative to pushbuttons

In applications that involve several operators working alongside a conveyor, it might not work well to have multiple E-stop pushbuttons at each work site. Instead, the most workable solution might be a rope switch, which is a cord of braided plastic-coated wire that's installed horizontally across the points of hazard generated by rotating machinery and conveyor motion.

A rope switch can cover the entire machine, and anyone at any spot on the conveyor can pull it. When pulled, it causes the attached switch to generate an emergency stop. For operators working in environments with explosives and similar hazards, rope switches are often the best choice, as these promote a stronger and more robust enclosure.

Common E-Stop Button Characteristics

Emergency stops are a must-have a for any safety system, as they are often the last resort for stopping or mitigating a major accident on the factory floor. We've discussed the specific requirements for the layout, color, shape of an E-stop pushbutton, but there are also several requirements for E-stop behavior that need to be considered. (Keeping in mind that there may also additional regulatory requirements depending on local regulations, industry, and the facility type/location.)

1. The E-stop must have positive operation.

Emergency stops must be designed so that, upon their activation, dangerous movements and operations of the machine will be stopped as quickly as possible without creating additional hazards. If they aren't activated, then the machine must stay running by default. This is what's meant by "positive operation."

2. The E-stop function must be available and in operation at all times.

At every operator station, there must be an emergency stop ready to be activated whenever necessary. The effects of an E-stop – namely, the ceasing of hazardous machine motion – must be maintained until the device can be manually reset according to ISO 13850-2006. This prevents machinery from starting up prematurely while the situation is being investigated.

3. There can't be a padlock on the E-stop.

Having a padlock on the emergency stop device gives the impression of lockout/tagout (LOTO), which is a terrible application for an E-stop. Requirements for lockout stipulate that the hazardous energy sources must be physically isolated or blocked, and control systems that include interlocks and emergency stops are unable to meet these requirements in full.

4. The E-stop shouldn't stand in for other necessary safety measures.

Key safeguarding measures and functions such as light curtains, interlock devices and comprehensive safety training for operators must not be overlooked simply because an emergency stop is in place. These measures are just as important and should always be part of the risk reduction strategy for a machine.

5. The E-stop should ideally be activated just twice per year.

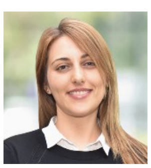
Assuming that there's no need to stop hazardous motion in a given year, then the emergency stop should only be activated twice over this time period for the purpose of manual testing. Some manufacturers set things up so that operators use the E-stop for routine machine shutdowns, but this is a standards violation and will lead to the early breakdown of the device.

Figure 2 – A commonly used e-stop button installation

Figure 2 shows a typical e-stop button installation that is used for machinery. Notice the red retentive mushroom head push button, with the yellow collar behind it identifying it as an emergency stop. This particular model uses a "twist to release" feature. Depending on the machinery application, this button may also be paired with a Machine Safety Relay and/or a larger line-stop based e-stop system.

Interested in learning more about e-stops and their applications? Additional whitepapers can be found on the OMRON website at https://automation.omron.com . There are also a large collection of technical standards documents and regulations that must be followed when it comes to e-stops. Your local OMRON application specialist can help you navigate the e-stop requirements for your local area.

About the Author



Pamela Horbacovsky is currently the Product Manager for Safety at OMRON Automation Americas and has previously served as OMRON's Safety & Services Sales Leader for Mexico. Before Omron, she worked for Magna CIMS and Formex, as an Automation Engineer leading the design and implementation of assembly lines. Her educational background includes a degree in Electronic Engineer at the National University of Cordoba, Argentina, an MBA from EUDE Business School and she is a certified Functional Safety Engineer for Machine Safety by TUV Rhineland. Contact: pamela.horbacovsky@omron.com

TECHNICAL ARTICLE

Primer on Machine Safety E-Stop Categories

By Graham Nasby, City of Guelph Water Services

Since we have an article on best practices when it comes to selecting e-stop technology, it seems only natural to have a brief primer on machine safety "emergency stop" categories. In North America, the terminology for emergency stop "category" typically originates from these published technical standards: IEC-60204-1 and NFPA-79 among others. Depending on the geographic area or industry, there may also be additional local technical standards as well. For example, in Canada the CSA C22.2 No. 301 technical standard applies.

Yes, terminology does matter. Each of these standards does have specifically defined terms about how to refer to emergency stop systems, and specifically safety stop systems. For example, in these standards, an e-stop is referred to as a "stop category". The word "emergency" is more a descriptor of how/when the stop is being called upon to function.

As a best practice, an e-stop should only be used for actual emergency situations. During normal operations, the preferred way of shutting down equipment should always be to use its normal control system and/or normal operator input. A category-rated rated stop system should only be used emergency situations. For many pieces of equipment, the emergency stop may also not be preferable since it will often prioritize quick stopping of equipment for safety, rather than a slower stop to avoid equipment damage.

Here is a summary of the typical "stop categories" used:

	IEC 60204–1[1]	NFPA 79[2]	CSA C22.2 No. 301[3]
0	stopping by immediate removal of power to the machine actuators (i.e. an uncontrolled stop)	is an uncontrolled stop by immediately removing power to the machine actuators.	stopping by immediate removal of power to the machine actuators (i.e., an uncontrolled stop;
1	a controlled stop with power available to the machine actuators to achieve the stop and then removal of power when the stop is achieved;	is a controlled stop with power to the machine actuators available to achieve the stop then remove power when the stop is achieved.	a controlled stop with power available to the machine actuators to achieve the stop and then removal of power when the stop is achieved;
2	a controlled stop with power left available to the machine actuators.	is a controlled stop with power left available to the machine actuators.	a controlled stop with power left available to the machine actuators.

This article is only a brief summary. A longer discussion of these standards and how they apply to "safety stop" categories, can be found in Doug Dixon's excellent article on Machine Safety 101 entitled "Emergency Stop Categories"[4]. As with all safety systems, it is always recommended to check with a specialist that is familiar with the specific requirements of the local jurisdiction of the installation.

[1] IEC 60204–1, Safety of machinery – Electrical equipment of machines – Part 1: General requirements (aka EN 60204–1)
[2] NFPA 79, Electrical Standard for Industrial Machinery
[3] Industrial electrical machinery. CSA Standard C22.2 No. 301. 2016.
[4] https://machinerysafety101.com/2010/09/27/emergency-stop-categories/

TECHNICAL ARTICLE

Automated Mass-Conversion of Code when Migrating Industrial Controller Platforms

By James Redmond, Schneider Electric

Replacing an aging control system which has reached end-of-life can be a daunting undertaking. There are many aspects to consider. These can include: I/O wiring, controller hardware, control panels, control system networks, servers, storage hardware and operator workstations. Furthermore, there is the software – also known as control system code – that ties the entire system together. In even a medium-sized control system it is not uncommon, for the existing code to represent several person-years of programming investment. Fortunately, there are now several automated tools available to help with the effort to translate control system code as part of a system migration project.

Introduction: Nothing lasts forever

There are many challenges in maintaining an aging distributed control system (DCS), PLC or RTU install base. Older sites, in many cases, include solutions dating back to the 1980s or 1990s and were developed using software tools that may no longer be available or able to run on modern computers. Documentation, describing the design and/or implementation of a specific application, can often be lost in the intervening decades. In addition, the skills and experience necessary to employ these legacy development tools may not have been maintained. It is not uncommon to find situations in which the software developer, who originally wrote, tested and installed the solution, has left the organization, and because the site kept performing as expected for many years, no further effort was made to build the capacity to maintain it. A final set of problems can occur due to these applications residing on hardware that has become obsolete. As the stock of spares is diminished over time, the ability to maintain operations at that site becomes increasingly difficult and risky.

Aside from aging equipment and loss of skills, and even where the systems are operating as designed, increasing demands and regulations may mandate a new methodology to evolve away from an older platform.

Consider, for example, the focus of the 2019 WEFTEC conference on cybersecurity at a hardware and software level[1] or a recent example of an NSA report which highlighted the vulnerabilities of several commonly used PLCs[2]. These problems are not unique to the water/wastewater field. Older PLCs and RTUs will need to be replaced someday.

Control System Software Development Environments

Despite the evolution of industrial automation in recent years, the development of PLC and RTU applications is often performed in isolation, by users employing manual procedures and a range of tools. This is further complicated by the fact most industrial control system software tools are propriety in nature and often specific to each individual control system platform and hardware type.

This wide variation of software development tools in the marketplace is, in large part, been a product of the platform-specific implementations of IEC 61131-3, produced by PLC and RTU manufacturers. Fortunately, this is starting to improve as the automation market continues to develop. However, while many newer PLC and RTU platforms have taken efforts to ease development and to facilitate more sophisticated development practices, this does not address the aging install base used to control and monitor water wastewater sites.

An example of an industrial automation code development environment can be found in Figure 1:

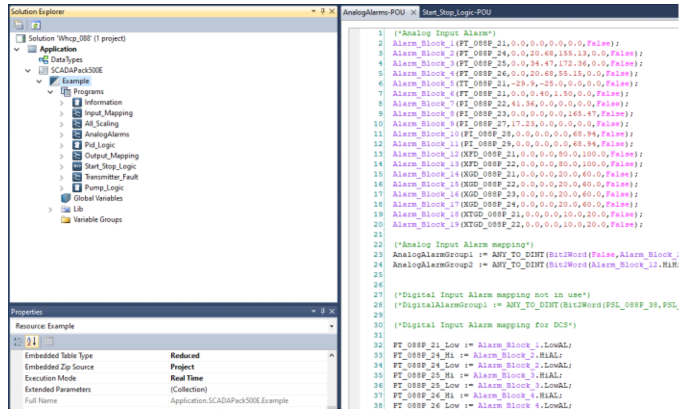


Figure 1 – Example of SCADAPack Workbench Structure Text Application

Why automated conversion

Due to the many different types of controllers out there and code development environments, the use of code conversion tools can be a helpful tool when undertaking a control system upgrade.

The availability of code conversion tools can be especially helpful when confronted with an installed system that includes these features:

1. Large number of obsolete/end-of-life RTUs and PLCs
2. Large numbers of RTUs and PLCs
3. A mix of different RTUs and/or PLCs
4. A variety of unique applications

Figure 2 shows some of the various PLC and RTU models that are available from just one Automation Supplier.

Figure 2 – Example of a Mix of PLCs and RTUs from one Supplier

Challenges of manual conversion

To address these site maintenance barriers, system operators should take an approach to proactively migrate applications from aging platforms to newer platforms that can be sustainably maintained. A major challenge to this approach is the diversity of platforms that can require replacement. This creates a practical barrier in that programmers, looking to migrate a system from an older RTU or PLC to a newer RTU or PLC, must learn each individual platform.

Consider the steps required now for a user to convert an application from one platform to another are as follows:

1. Study the platform from which the solution is being ported (the source platform) including its tools.
2. Create a development environment for the source platform.
3. Manually convert the code from the source platform to the target platform.
4. Verify that the target platform application performs as expected when compared to the source platform application.
5. Document the updated application.

An example of the extensive requirements can be viewed online[3]. One consideration specific to the conversion of IEC 61131-3 code from the source to the target platform is that the time involved with the code conversion can vary significantly based on the language being used. For instance, the conversion of structured text (ST) code can easily be performed manually using a cut and paste method. It has been observed, however, that the copy/paste/modify approach can often prove to be error prone as the process is dull and repetitive and thus leaves developers less focused.

Consider the following example showing two code fragments from SCADAPack™ Workbench and its direct equivalent in RemoteConnect™ Logic Editor:

SCADAPack Workbench – Code Example

```
TON_NoTorque(
    Well[0].Control.iMode =
    eMODE_TORQUE AND
    Well[0].Status.Drive.iMotorTorque <= 0 AND
        (Well[0].Status.iMode = eSTATE_AUTO OR
        Well[0].Status.iMode = eSTATE_STARTUP),
    T#30s);
iTemp := F_DEL(i_sFileName + '.bak');
```

RemoteConnect Logic Editor – Code Example

```
TON_NoTorque(
    Well.Control.iMode = 3 AND
    Well.Status.Drive.iMotorTorque <= 0 AND
        (Well.Status.iMode = 300 OR
        Well.Status.iMode = 30),
    T#30s);
F_DEL_0(CONCAT_STR(i_sFileName, '.bak'), iTemp);
```

Observe that although each platform uses very similar code, even in these simple cases, differences can occur, including: defined words being supported in one environment and not the other, the need to replace a function with a function block (FB) and the syntax of a FB call being different.

These challenges are only increased when working with the graphical IEC 61131-3 languages, ladder diagrams (LD) and function block diagrams (FBD), where the challenges of differing syntax, custom functions, and platform-based timing are coupled with the need to graphically recreate the implementation. Also, the interpretation of the graphical languages IEC 61131-3 may vary between development environments.

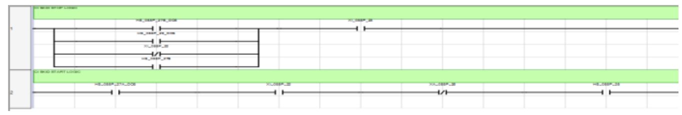


Figure 3 – Ladder Diagram (LD) Code Example

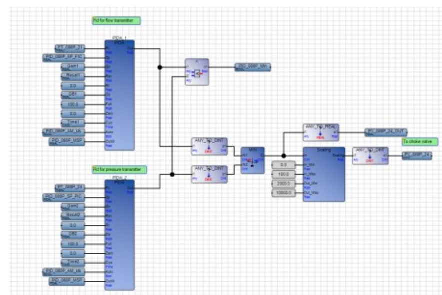


Figure 4 – Function Block Diagram (FBD) Code Example

Considering the need to repeat this process for each application, the time and effort required to migrate to a new platform can increase significantly.

Automated Code Conversion Tools

A powerful approach that can mitigate the significant costs involved in PLC and RTU modernization projects for system operators, consultants and developers, with this manual, platform-by-platform, and labor-intensive approach, - while avoiding the trap of attempting to indefinitely support aging platforms - is the use of automated conversion tools. The primary benefits of an automated conversion approach are reduced costs, time and risk. In some situations, migration costs can be reduced by up to 40% using an automated approach.

For example, when using one such automated code conversion tool, the following workflow could be used:

1. Conduct source code analysis to transform the source code into a generic platform independent set of source files.
2. Replace references to source PLC or RTU to references to target PLC or RTU.
3. Generate the code for the target platform.
4. Manually adjust code on target platform (the automatic conversion tool will indicate where this is required).

A diagrammatic representation of the automated code migration workflow is shown in the following figure:

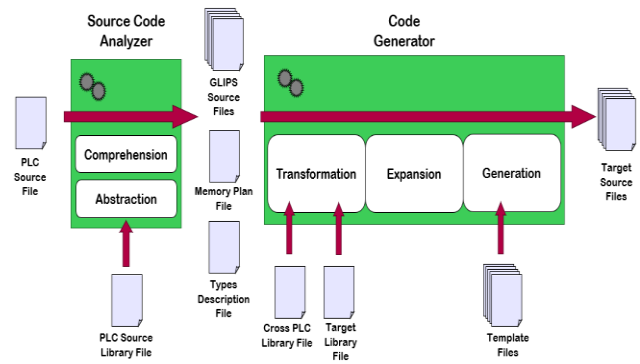


Figure 5 – Automated Code Conversion Process

An example of an automated code conversion tool is the EcoStruxure Control Engineering Converter, which is a tool used with Schneider Electric PLCs for the Modicon and SCADApack product lines. The EcoStruxure tool is able to import source code and convert it into a platform-independent GLIPS language. GLIPS is sufficiently abstract such that it can be transformed so as to produce target code for a variety of PLCs, RTUs, and other systems used for embedded applications (C code can be generated too). The flexibility of this platform-independent code is essential to an effective code translation system.

When looking at automated code conversion tools for doing code conversions using the IEC 61131-3 programming languages, here are some of the code conversion features that one should look for:

- Memory Organization: variables, points, registers, sizes, locations
- Data Types: simple types, structures, enumerations, functions, FB
- System Libraries
- System Information: status variables, timers
- Application Structure: tasks, program organization unit (POU)

In addition, the conversion process should support the translation and conversion between all five IEC 61131-3 languages (ST, LD, FBD, SFC, and IL) and advanced transformation mechanisms can even help customize the target code to specific needs such as going from one language to another for a given section. For example, having a tool to convert subroutines from Structured Text (ST) to Ladder Diagram (LD) would be a helpful feature for software code migration.

One thing to keep in mind is that no matter how advanced a code conversion tool is, there will be some parts of the conversion that will still need to be done manually by a skilled programmer familiar with both the old and new platforms.

Some tasks, due to the wide range of platforms and their unique implementations, typically require a programmer to manually update them. These tasks commonly include the assignment of I/O to PLCs, RTUs, and expansion modules, the configuration of communication port settings, security and credentials. This challenge can be expected for protocols more complex than Modbus™ such as DNP3 or IEC 60870-5-104.

Once the application has been converted by the tool, the development team, freed from the tedious task of code translation, is now positioned to focus on completing the migration to the new install base by allowing the developers to concentrate on finalizing, validating, and commissioning the new platform. This can help to leverage fully the capabilities of the new platform which is a hidden benefit of migrating beyond duplicating the functions of the obsolete system.

Summary

There are many challenges associated with maintaining aging systems currently in use by many water utilities. Personnel retirements, equipment-end-of life, changing regulations and the need for more sophisticated or efficient operations can force the need to move away from older platforms. The cost of a manual program-by-program change can be prohibitive due to the time required, by the developer performing the conversion, to learn the old system, and to then manually duplicate it on the new platform. The manual change approach also creates risk.

Water system operators should, when planning a large migration project, consider an approach that uses the automated conversion of PLC and/or RTU code from the old platform to the new. The benefits of using an automated approach increase as the mix of source platforms, source applications, and size of the install base increases. The automated conversion of PLC and RTU code has been used successfully in other industries and this experience can benefit the water and wastewater field[5]. The key benefits of this automated approach are reduced costs, time and risk.

About the Author

James Redmond, CD is the acting product line manager for the SCADAPack RTU product line at Schneider Electric. He has over six years of experience in the SCADA and telemetry industry. Prior to his time in industrial automation sector, he designed and implemented automated equipment for various industries. James also served for 14 years as an Engineer Officer with the Canadian Forces (Primary Reserve). James received his Bachelor of Engineer Science degree from the University of Western Ontario in 2004. He is based out of Ottawa, Ontario, Canada. Contact: james.redmond@se.com

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STANDARDS UPDATE

ISA112 SCADA Systems Standard: The Document Begins to Take Shape

By Graham Nasby, ISA112 standards committee co-chair

Since its establishment in late-2016, the ISA112 SCADA Systems standards committee has been hard at work developing a new management lifecycle for the long-term management of SCADA systems and a standardized workflow for managing the SCADA aspects of capital upgrade projects.

Based on work to date, the committee released the draft ISA112 lifecycle and the ISA112 model architecture diagrams in mid-2020. PDF copies are available at www.isa.org/isa112/ See the Summer 2020 issue of the WWID newsletter for an introduction to these two reference diagrams. These diagrams will also be soon joined by several SCADA system maturity model diagrams that the committee is currently working on.

In parallel with diagram development, the committee has been working on the actual text for the upcoming ISA112 standards documents. This has included writing the Table of Contents and developing "point-form" content for each of the document's various sections. Individual volunteer section authors have been using this outline to create the first draft of the documents' written content.

As of January 2021, the ISA112 master working document has reached a staggering 393 pages with about 75% of the written content now at the first draft stage. It is expected that once the first rough draft is complete, the page count will reach approximately 500 pages. The committee will then begin the process of editing/refining the rough draft content, and then portioning the text into the core ISA112 standards documents and associated ISA112 technical reports.

It is expected the main ISA112 SCADA Systems standard will be published in 3 parts, namely: Part 1: SCADA Terminology and Diagrams, Part 2: Requirements for the ISA112 management lifecycle, and Part 3: Requirements for the ISA112 model architecture. The development of standardized SCADA terminology has been a major goal of the ISA112 committee. Part 1 will provide a standardized way for end users, vendors, consultants and contractors to communicate to each other when discussing SCADA systems. The Part 1 document will also include the already-developed ISA112 SCADA management lifecycle diagram and ISA112 model architecture diagram along with a brief introduction of each. The committees is aiming to publish Part 1 in 2022/2023.

At present the ISA112 committee comprises of over 210 volunteer SCADA experts from around the world and from a wide range of industries. To find out more about the ISA112 SCADA standards committee visit www.isa.org/isa112

TECHNICAL ARTICLE

How Can We Improve Operator Trust in PID Controllers?

By Dan Warren, Michel Ruel, Peter Morgan, Nick Sands, Pat Dixon and Greg McMillan (a whole bunch of ISA fellows)

The following technical discussion is part of an occasional series on https://blog.isa.org *that showcases the ISA Mentor Program, authored by Greg McMillan, industry consultant, author of numerous process control books, 2010 ISA Life Achievement Award recipient, and retired Senior Fellow from Solutia, Inc. (now* Eastman Chemical*). Reprinted by permission.*

We start off with a question from Danaca Jordan. Danaca is a founding member of the ISA Mentor Program and serves as VP of ISA's Professional Development Department. Outside ISA, Danaca is a Digital Manufacturing Center of Excellence engineer for a major specialty chemical company, where she drives enterprise-wide digital transformation implementations focused on manufacturing data.

Danaca Jordan's Question

As our controllers get more complex, what are the options to convey what is happening behind the scenes to an operator who must trust the controller?

Dan Warren's Answer

Interesting question. And one that I have had lots of experience with. For me, it has been simple education. But the education, as well as examples, have to be along the lines people will understand. There is no use trying to explain the complicated algorithms or math that we (unfortunately) sometimes tend to bog ourselves down with.

I have heard more than enough references to smoke and mirrors or black box systems than you would care to imagine. So I do my best to use examples from day-to-day life—like say, for example, driving a car. Plus, even though most facilities like to do group training, I find it more effective doing one-on-one. This way, the individual pays attention, asks questions, and doesn't feel as embarrassed or awkward about asking a question or clarifying a statement. Plus, I make myself available on the plant floor as often as I can. In this way, I make myself as approachable as possible. But I also make sure that we are in a safe location when explaining.

Also, it's good to not get things too complicated. Keep things simple, and pick on one scenario at a time.

Michel Ruel's Answer

Some basic principles:

- Explain the goal and the objectives; not what is under the hood, but what it does
- Work with operators; always add extra time to your projects for one-on-one training
- Use example from day-to-day life: air-conditioning, car driving, and so on
- Train the trainers with the approach above
- Design user interface with tips explaining the purpose of counterintuitive actions
- For example, if you added a function unusual to the operator, explain it or add an extra element to explain it on the human machine interface (HMI)
    - E.g., SP filter, add a dashed line showing what is sent to PID controller
    - E.g., replace the arrow displaying SP by the allowable range if a level loop is tuned for absorbing variability
- Spend time with the operators and have fun with them

Peter Morgan's Answer

It's important to treat the operator as **both a partner and a client** in providing control solutions—a partner because they can share insights on process behavior; a client because after all is said and done, the operator has to live with the solution.

Engaging the operator in providing solutions—in particular with respect to operator interface and other HMI provisions—while having practical benefit, can add to the confidence the operator has in the automation system and helps build a **relationship of trust** between the operator and control specialist.

Nick Sand's Answer

Take time to build the relationship with the operators to start with. In our in-house training class, this section is subtitled "The Power of Doughnuts." Spend time with them routinely, **just to check in**.

For existing control loops, monitor and assess the performance. If the operators do not trust a controller, there could be a good reason why (such as tuning or valve sizing). Talk to the operators to find out what they see as an issue, and what they might suggest as a solution.

For new control loops, relate the loop's function to how the operator would take action manually. **Good control loops make life easier for the operator.** If they see that, they will be motivated to accept it. Track the loop's performance and utility and follow up on issues.

And follow the top rule for tuning and other modifications—don't make a change on a Friday unless you plan to work the Saturday.

Pat Dixon's Answer

Trust is lost when something doesn't work or doesn't meet expectations. We know that there is an unfortunate abundance of loops that were never well-tuned, or were not maintained. The best solution is to fix them. In other cases, something may be performing to the control engineer's expectations, but not the operator's expectations. That is a case of communication to understand what the operator sees, how they perceive it, and **seeking common ground**.

The question asks about controllers getting more complex. It does not specifically say PID control is more complex. It should be no more complex that it has ever been. Of course, new features have been added that can make the configuration for a control engineer more complex, but for the operator, there should not be any more complexity to a PID. They should actually be better able to visualize faceplates and trends than in the past.

I suspect the more complex controllers that are being referred to are advanced loops with feedforward, cascade, or predictive control. If you have a large matrix in a multiple input multiple output (MIMO) controller, it is understandable why it is more complex. Especially when an optimizer is moving things based on criteria that the operator may not understand, it can become challenging. Getting good performance from the controller, while spending the time with operators to gain common understanding, is a bigger job in these cases than with a single loop, but the same remedy works.

Lastly, there need to be reasonable expectations of what operators should have to know. Explaining algorithms and configuration is not likely to be helpful. Therefore, I do not think the operators need to know what is behind the scenes. Their scene needs to make sense to them.

Greg McMillan's Answer

It is quite a challenge because of little fundamental understanding of process dynamics and the basic action of proportional, integral, and derivative modes that varies with Form and Structure. On top of this, we have the many additional features of setpoint weight factors and lead-lag, and strategies such as cascade, feedforward, ratio, and override control. There is a rough draft of an ISA-5.9 Technical Report "PID Algorithms and Performance" that automation engineers could use to bring themselves up to speed, which is a critical step because most PID controllers are not tuned as well as needed, and most capability of the PID is underutilized.

All of this leads to legitimate lack of confidence in the PID. A digital twin with simple dynamic process simulations could help enable an automation engineer to build their foundation of knowledge and improve the existing PID controllers. Some simple scenarios can be used to provide some hands-on-learning to increase knowledge and appreciation of PID control. Extensive operator input on what is needed during startup and transitions and how to deal with abnormal operation can be used to automate the best of their actions and knowledge as changes in PID modes, outputs, and setpoints via procedure automation and state-based control. The Control Talk column "Continuous improvement of continuous processes" describes these opportunities.

The concepts and actions are similar to what needs to be done in fed-batch control. Testing and training is critical to make sure the PID controller can deal with all types of scenarios. The repeatability gained can enable continual improvement by again seeking operator input. We can elevate the role of the operator to be one more of supervisory control and a source for ongoing improvement that can accelerate with practice. The benefits of digital twins for training and embedding operator knowledge are well-recognized. We just need to open our eyes and expand our minds to think of simulation as a continual learning experience for everyone who plays a role in the automation system success. **We should not underestimate** the capability of operators to learn concepts and their appreciation of a greater understanding of what the automation system and process is doing.

Online process metrics that show process efficiency and capacity can help operators realize the benefits offered process control improvements the consequences of the PID not being in the highest mode. There are some challenges to make sure inputs are synchronized with outputs, there is no inverse response, and the signal-to-noise ratio is good. A moving average helps address these issues. These metrics should be developed and tested in the digital twin typically with the model used for operator training.

Spending as much time as possible in the control room and becoming good friends with the operators goes a long way toward building relationships and mutually beneficial conversations. Bringing in food helps (e.g., po'boys work well in Louisiana). If they share some of what's cooking in the kitchen, you know you are "in good." I especially loved the Cajun food.

Humans have difficulty realizing that an action done now will not be seen in process response until after one total loop dead time, and that the rate of change can be quite slow—particularly for near and true integrating processes. This plays a big role in operators trying to manually control a process and their concerns about what a PID is doing.

In two control rooms, I have had operators say there is something wrong with the PID because on reactor heat-up with split range control, the coolant valve opened when the temperature was below setpoint. If the operator could see the trend and realize that, due to dead time, the coolant valve needed to open, they would not have complained. Integral action would not open the coolant valve until the temperature rose above setpoint, but this would be too late, causing detrimental potentially unsafe overshoot. Proportional and derivative action provides the anticipatory action needed. For this and other reasons, reset action is often orders of magnitude too large and gain action too small. The digital display on faceplates reinforces a lack of understanding of anticipatory action needed.

I think a particularly effective confidence builder would be a smart trend built by automation engineers that would **clearly show the slope** and include, via a dead time block, **predicted values** that progress from current value to at least one dead time into the future. The predicted values are simply a slope multiplied by time increments added to the current value. The slope is the input of the dead time bock minus the output divided by the block dead time. The block dead time may be increased from the total loop dead time to provide better signal to noise ratio and recognition of slope for slow rates of change. The dead time in the response to a small setpoint change is fairly easy to identify, and an exact value is not important for the slope and predicted values.

Oscillations can be detected and probable source identified to correct problems and reduce confusion and loss of confidence and imaginary solutions that are a distraction, wasting time. Some fixes and guidance by automation engineers are possible from some simple observations.

- If the oscillations occur in manual, they are due to another loop oscillating or noise
- If the oscillations in auto are constant amplitude, they are limit cycles most likely caused by valve or variable frequency drive dead band or resolution
- If the oscillations in auto are decaying, they are most likely due to tuning
- If the period of the oscillations is close to four times the dead time, the oscillations are most likely due to too much proportional action
- If the period of the oscillations is five to 10 times the dead time, it is most likely due to too much integral action
- If the period is much larger than 10 times the dead time for processes that are ramping with no deceleration in four dead times, there is too little proportional action and too much integral action; in many cases, simply trying a significant reduction in integral action may confirm the problem

For **feedforward** or **ratio control**, a response to these control actions that occurs before or after and is the opposite of the process response trying to be corrected, the feedforward or ratio control action is arriving too soon or too late, respectively. Fixing this builds operator confidence.

Override control is confusing to operators and engineers. Some calculations can help. The time during the last batch or last shift that each controller was selected can show the controllers and their process variables most significantly limiting process performance possibly leading to some better setpoints or better equipment or operating conditions. Also, a predicted PV at which point each override controller would be suspected of taking over could be displayed.

If you have a digital twin with a high-fidelity real time simulation running in sync with same setpoints of the actual plant, there could be an option of temporarily running faster than real time to see what is going to happen. This could be used offline as well to achieve a much greater confidence in what the PID controller is doing for different scenarios and how the operator can spend more time thinking of improvements, rather than dealing with moment-to-moment changes.

Additional ISA Mentor Program Resources

See the ISA book *101 Tips for a Successful Automation Career* that grew out of this Mentor Program to gain concise and practical advice. See the *Control Talk* column How to effectively get engineering knowledge with the ISA Mentor Program protégée Keneisha Williams on the challenges faced by young engineers today, and the column How to succeed at career and project migration with protégé Bill Thomas on how to make the most out of yourself and your project. Providing discussion and answers besides Greg McMillan and co-founder of the program Hunter Vegas (project engineering manager at Wunderlich-Malec) are resources Mark Darby (principal consultant at CMiD Solutions), Brian Hrankowsky (consultant engineer at a major pharmaceutical company), Michel Ruel (executive director, engineering practice at BBA Inc.), Leah Ruder (director of global project engineering at the Midwest Engineering Center of Emerson Automation Solutions), Nick Sands (ISA Fellow and Manufacturing Technology Fellow at DuPont), Bart Propst (process control leader for the Ascend Performance Materials Chocolate Bayou plant), Angela Valdes (automation manager of the Toronto office for SNC-Lavalin), and Daniel Warren (senior instrumentation/electrical specialist at D.M.W. Instrumentation Consulting Services, Ltd.).

About the Lead Author

Gregory K. McMillan, CAP, is a retired Senior Fellow from Solutia/Monsanto where he worked in engineering technology on process control improvement. Greg was also an affiliate professor for Washington University in Saint Louis. Greg is an ISA Fellow and received the ISA Kermit Fischer Environmental Award for pH control in 1991, the Control magazine Engineer of the Year award for the process industry in 1994, was inducted into the Control magazine Process Automation Hall of Fame in 2001, was honored by InTech magazine in 2003 as one of the most influential innovators in automation, and received the ISA Life Achievement Award in 2010.

ISA STANDARDS

List of ISA Standards Committees

By Graham Nasby, City of Guelph Water Services

Ever wondered how many active standards committees that the ISA has? Look no further, here is a listing:

- ISA2, Manometer Tables
- ISA5, Documentation of Measurement. and Control Instruments and Systems
- ISA7, Instrument Air Standards Committee
- ISA12, Electrical Equipment for Hazardous Locations
- ISA18, Instrument Signals and Alarms
- ISA20, Instrument Specification Forms
- ISA37, Measurement Transducers
- ISA42, Nomenclature for Instrument Tube Fittings
- ISA50, Signal Compatibility of Electrical Instruments
- ISA52, Environments for Standards Laboratories
- ISA60, Control Centers
- ISA67, Nuclear Power Plant Standards
- ISA71, Environmental Conditions for Process Measurement and Control
- ISA74, Continuous Weighing Instrumentation
- ISA75, Control Valve Standards
- ISA76, Composition Analyzers
- ISA77, Fossil Power Plant Standards
- ISA82, Electrical and Electronic Instrumentation
- ISA84, Instrumented Systems to Achieve Functional Safety in the Process Industries
- ISA88, Batch Control Systems
- ISA90, Instrumentation and Computer Grounding
- ISA91, Criticality Ranking for Instrumentation
- ISA92, Performance Requirements for Industrial Air Measurement Instrumentation Related to Health and Safety
- ISA95, Enterprise/Control Integration Committee
- ISA96, Valve Actuator Committee
- ISA97, In-Line Sensors Committee
- ISA99, Industrial Automation and Control Systems Security
- ISA100, Wireless Systems for Automation
- ISA101, Human-Machine Interface
- ISA102, Development Electrical Systems
- ISA103, Field Device Tool Interface
- ISA104, Device Integration
- ISA105, Commissinoning, Loop Checks & Factory Tests
- ISA106, Procedure Automation for Continuous Process Operations
- ISA107, Advanced Measurement Techniques for Gas Turbine Engines
- ISA108, Intelligent Device Management
- ISA111, Unified Automation for Buildings
- ISA112, SCADA Systems
- USTAG65, ISA-administered U. S. Technical Advisory Group (USTAG) for IEC TC65, Industrial-Process Measurement, Control, and Automation
- USTAG65A, ISA-administered U. S. Technical Advisory Group (USTAG) for IEC SC65A, System Aspects
- USTAG65C, ISA-administered U. S. Technical Advisory Group (USTAG) for IEC SC65C, Industrial Networks
- USTAG65E, ISA-administered U. S. Technical Advisory Group (USTAG) for IEC SC65E, Devices and Integration in Enterprise Systems

ISA Standards help automation professionals streamline processes and improve industry safety, efficiency, and profitability. Over 150 standards reflect the expertise from over 4,000 industry experts around the world. Since 1949, ISA has been recognized as the expert source for automation and control systems consensus industry standards.

More information about ISA standards can be found at: https://www.isa.org/standards-and-publications/isa-standards

For more information on ISA Standards, contact Charley Robinson, Manager of ISA Standards, crobinson@isa.org .

AUTO-QUIZ: BACK TO BASICS

Instrument Deadband Basics

From the ISA Certification Program

This automation industry quiz question comes from the ISA Certified Control Systems Technician (CCST) program. CCSTs calibrate, document, troubleshoot, and repair/replace instrumentation for systems that measure and control level, temperature, pressure, flow, and other process variables

Question: The dead band of an instrument is:

a) the band that prevents the instrument from being tampered with by unauthorized persons
b) the range of valves for which the instrument gives inaccurate readings
c) the size of the instrument indicated by the divisions on the scale of the instrument
d) the range that an input signal may be changed on reversal of direction without an observable change in the output
e) none of the above

Answer:

In process instrumentation, the dead band is the range through which an input signal may vary, upon reversal of direction, without initiating an observable change in output signal. *The Automation, Systems, and Instrumentation Dictionary* adds these notes as further definition.

There are separate and distinct input-output relationships for increasing and decreasing signals.

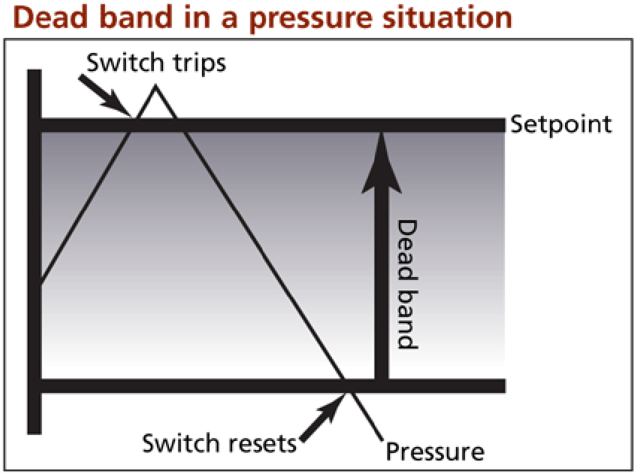
Dead band produces phase lag between input and output.

The instrumentation industry expresses dead band as a percentage of span.

ANSI/ISA-51.1-1979, revised 1993, pertains to dead band.

The correct answer is **D**.

Dead band in a pressure situation



Source: Alicat Scientific (www.alicatscientific.com)

Reference: "The Automation, Systems, and Instrumentation Dictionary", Fourth Edition, ISA Press, 2019. 582 pages.

ISA CAP and CCST certification programs provide a non-biased, third-party, objective assessment and confirmation of an automation professional's skills.

The CAP exam is focused on direction, definition, design, development/application, deployment, documentation, and support of systems, software, and equipment used in control systems, manufacturing information systems, systems integration, and operational consulting.

Certified Control System Technicians (CCSTs) calibrate, document, troubleshoot, and repair/replace instrumentation for systems that measure and control level, temperature, pressure, flow, and other process variables.

Question originally appeared in the ISA Certified Automation Professional; (CAP) program column of https://blog.isa.org. Reprinted with permission.

SOCIETY NEWS

Make Way for 2021!

By Steve Mustard, 2021 ISA Society President

I would like to take this opportunity to thank Eric Cosman. I'm sure that charting a course for ISA through a once-in-a-century pandemic is not how Eric envisaged leading the Society through its 75th anniversary, but I am very grateful for everything he did. I am thankful that he will be around in 2021 to support me with his wise counsel as past president, along with another trusted colleague **Carlos Mandolesi**, our president-elect secretary.

By my count, I am the fourth non-native North American to serve as president, and perhaps the second dual citizen (after Eric). I, together with a diverse executive board, look forward to working for the interests of automation professionals around the world.

The first address by each ISA president is usually a call to action, to take the opportunity given by the new year to start afresh, re-examine priorities, and move ahead with renewed energy. In 2021, this call has even more significance.

We have all spent the last year in semi-isolation. Now, with vaccines being distributed, there is a light at the end of the tunnel. Perhaps by the middle of 2021, things will be returning to "normal." I doubt, however, that we will return to how things were pre-pandemic. Businesses have **learned to adapt to remote working**—and, in many cases, have seen efficiency improvements as well as financial benefits. People who previously could not envision doing business remotely have seen that it can and does work, so why go back to the grind of sitting in traffic jams and airports if it is not necessary?

ISA spent 2020 adapting to these changes. When your business is based around in-person instruction and in-person events, necessity becomes the mother of invention. ISA staff and volunteers quickly repurposed material and plans so that online instruction and online events were available.

Despite the potential to return to in-person working in 2021, I expect the demand for online instruction and events will continue to be significant. Online instruction, especially in modular format, allows students to learn at their own pace; online events allow attendees to easily dip in and out as desired. In 2020, ISA even had its **first virtual Council of Society Delegates vote** on 34 recommended modifications to the bylaws. The fact that all but one of these recommendations passed was a significant milestone, but equally so was the fact that we proved we could do it virtually.

I hope you are all familiar with our vision and mission now. The vision is to create a better world through automation, and the mission is to advance technical competency by connecting the automation community to achieve operational excellence.

ISA's strategic plan is now focused on four interrelated objectives: industry reach and awareness, member development and engagement, technical education and certification, and leadership and business skill development.

Industry reach and awareness is about establishing ISA credibility and relevance in the automation profession. We want ISA to be **the home of automation**—the place where individuals and businesses come for advice, support, and guidance.

ISA, at its heart, is a member society. The aim of the member development and engagement objective is to ensure that membership comes with a clear value. We need to encourage more professionals around the world to join and move the society forward for the benefit of everyone in the profession.

ISA provides industry-leading technical education and certification opportunities. The board recognizes that ISA training needs to continue to evolve to meet the changing demands of the workforce. This includes adapting for members who want to consume educational material in smaller chunks on mobile platforms, and for those who need to learn new skills to enable them to compete in the age of digital transformation.

The final objective is about leadership and business skill development. We want to help our members develop their leadership skills for use in the Society and their day jobs. And we want to encourage the next generation of automation professionals to carry the Society and the profession forward.

ISA is your organization. I believe the more engaged you are, the more value you will receive. The best place to get started is ISA Connect, your community to connect with industry peers, share resources, and participate in technical conversations. To get the most out of your ISA experience, join the conversation at connect.isa.org.

You can also join any number of our technical divisions, engage in your local section to network with peers near you, and/or volunteer to help ISA with global projects. Create your profile on ISA Connect and check out volunteer opportunities at connect.isa.org/engage/volunteeropportunities. You can contact me by emailing me at president@isa.org, or you can find me on Connect.

I look forward to working with you all to create a better world through automation.

Steve Mustard
2021 ISA President

About the Author

Steve Mustard is an industrial automation consultant with extensive technical and management experience across multiple sectors. He is a licensed Professional Engineer (PE), ISA Certified Automation Professional® (CAP®), UK registered Chartered Engineer (CEng), European registered Engineer (Eur Ing), GIAC Global Industrial Cyber Security Professional (GICSP), and Certified Mission Critical Professional (CMCP). Backed by 30 years of engineering experience, Mustard specializes in the development and management of real-time embedded equipment and automation systems and cybersecurity risk management related to those systems. He serves as president of National Automation, Inc. Mustard writes and presents on a wide array of technical topics and is the author of 'Mission Critical Operations Primer," published by ISA.

Call for Newsletter Articles

The WWID newsletter is published four times a year (winter, spring, summer, and fall) and reaches the WWID's 2,000+ members. Each issue is approximately 16-32 pages long, and is electronically printed in color PDF format. A notification email goes out to all WWID members and it is available for public download at www.isawaterwastewater.com.

We are always on the lookout for good articles, and we welcome both solicited and unsolicited submissions.

Article submissions should be 500-2000 words in length and be written for a general audience. While it is understood that the articles are technical in nature, the use of technical jargon and/or unexplained acronyms should be avoided. We actively encourage authors to include several photos and/or figures to go along with their article.

We actively welcome articles from all of our members. However, we do ask that articles be non-commercial in nature wherever possible. One or two mentions of company and/or product names for the purposes of identification are acceptable, but the focus of the article should be technical content and not just sales literature. If you are unsure of whether your article idea is workable, please contact our newsletter editor for more information – we are here to help.

Some examples of the types of articles we are looking for include:

- Explanatory/teaching articles that are meant to introduce or explain a technical aspect of automation and/or instrumentation in the water/wastewater sector.
- Biographical stories about personalities and/or leaders in the water/wastewater sector.
- Case Studies about plant upgrades and/or the application of new technologies and techniques. This type of article must include at least two photos along with the article text.
- Pictorial Case Studies about a plant upgrade consisting of 4-6 photos plus a brief 200-500 word description of the project undertaken. The article should ideally include one to two paragraphs about lessons learned and/or advice for other automation professionals.
- Historical reflections on changes in technology pertaining to specific aspects of instrumentation or automation, and how these changes point to the future.
- Discussions about changes in the water/wastewater sector and how these affect automation professionals.

Once we receive a submission, we will work with you to edit it so it is suitable for publication in the newsletter.

Article submissions can be sent to the WWID newsletter editor Graham Nasby at graham.nasby@grahamnasby.com .

WWID Newsletter Advertising

The WWID newsletter is an excellent way to announce new products and services to the water/wastewater automation community. With a distribution of 2,000+ professionals in the automation, instrumentation and SCADA fields, the WWID newsletter is an effective targeted advertising tool.

The WWID newsletter is published quarterly, on the following approximate publication schedule:

- Winter Issue – published in January/February
- Spring Issue – published in April/May
- Summer Issue – published in July/August
- Fall Issue – published in October/November

Advertising in the newsletter is offered in full page, half-page and quarter page formats. Advertisements can be purchased on a per issue basis or for four issues at a time. The newsletter itself is distributed as a full-color PDF, so both color and black/white artwork is acceptable.

The current advertising rates are as follows:

Per Issue:

- Full page, full color (7" x 9"): $500
- Full page, full color, (8.5x11") , with bleed $600
- Half page horizontal, full color (7"x4.5"): $350
- Half page vertical, full color (3.5"x9"): $350
- Quarter page, full color (3.5" W x 4.5" H): $250

Per Year: Apply 20% discount if purchasing 4 ads at a time

Other sizes of advertisements are available, but are priced on an individual basis. Contact us for more information.

Please book advertising space as early as possible before the intended publication date. Artwork for advertisements should be submitted a minimum of two weeks prior to the publication date; earlier is always better than later. Artwork for advertisements can be submitted in EPS, PDF, PNG, JPG or GIF formats. EPS, PDF and PNG formats are preferred. Images should be at least 300dpi resolution if possible. A complete list of ad specs can be found at www.isawaterwastewater.om

The ISA Water/Wastewater Industry Division is run on a non-profit basis for the benefit of its members. Monies raised from the sale of advertising in the newsletter are used to help offset the cost of division programming and events. Like its parent organization, the ISA, the WWID is a non-profit member-driven organization.

For more information, or to discuss other advertisement sizes not outlined above, please contact the WWID newsletter editor Graham Nasby at graham.nasby@grahamnasby.com .

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About the ISA Water/Wastewater Industries Division

The ISA Water / Wastewater Industry Division (WWID) is concerned with all aspects of instrumentation and automated-control related to commercial and public systems associated with water and wastewater management. Membership in the WWID provides the latest news and information relating to instrumentation and control systems in water and wastewater management, including water processing and distribution, as well as wastewater collection and treatment. The division actively supports ISA conferences and events that provide presentations and published proceedings of interest to the municipal water/wastewater sector. The division also publishes a quarterly newsletter, and has a scholarship program to encourage young people to pursue careers in the water/wastewater automation, instrumentation and SCADA field. For more information see www.isa.org/wwid/ and www.isawaterwastewater.com